Jigsaw Lake: New studies lend further evidence of very dry times 8-10,000 years ago

by Ed Berg

Prof. Tom Lowell (l) and students Terry Workman and Alena Giesche take a sediment core in Jigsaw Lake. The core drill extends down through a hole in the plywood platform strapped onto two canoes. The core drill is pushed into the soft sediments by pulling on a rope whose force is multiplied by several sets of pulleys.
Photo Credit: Ed Berg

In a 2001 Refuge Notebook, I described a study of lake sediments at Jigsaw Lake which indicated that the lake level was roughly 40 feet lower about 8-10000 years ago. This was a very surprising discovery. The central Kenai would have to be very dry to lower any lake by 40 feet.

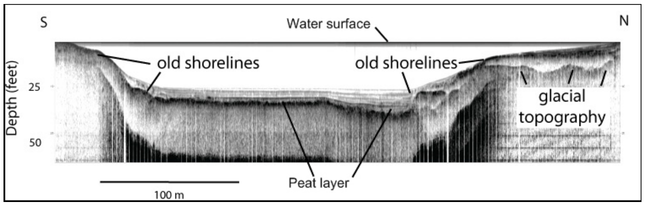
We are now revisiting Jigsaw Lake with some new technology that should allow us to reconstruct the history of this remarkable lake since the end of the last ice age.

Jigsaw Lake is located at the end of Swan Lake Road, 17 miles northeast of Sterling. Like most lakes on the Kenai, Jigsaw Lake is a kettle lake. It began life as a block of glacial ice imbedded in sands and gravels derived from the melting ice sheet that had flowed out across the Kenai Lowlands from the Kenai Mountains. This ice sheet did not pull back like modern valley glaciers, but simply fell apart with the rapid warming that started after the last glacial maximum 23,000 years ago. By 19,000 years ago the area from Sterling west to Cook Inlet was mostly ice-free. There would be a three more shorter and shorter re-advances of the glacier ice sheet during the next 5000 years, but they would not reach as far as Sterling and Jigsaw Lake.

Jigsaw Lake is a closed-basin (no outlet) lake with a small watershed perched on the drainage divide between the Moose River to the south and the Swanson River to the north. Because it has no streams for input, the lake is fed entirely by local precipitation via groundwater and spring snowmelt. This relatively "high and dry" position above the regional water table means that the lake level is very sensitive to the local climate, especially to changes in precipitation. Lakes downslope in the regional drainage have the groundwater table above them (upstream, so to speak) which acts like a buffering reservoir to keep their lake water levels relatively constant, whereas Jigsaw Lake has no such buffer. Indeed, the exposed shore apron around the lake indicates that the water level has fallen several feet in the last decade or so, with drier and warmer summers.

During June a team of geologists has been making seismic profiles of Jigsaw Lake and taking many sediment core samples. The seismic profile equipment is mounted on a canoe; it is basically like a high-class fish finder, bouncing sound waves off the lake bottom and sediment layers. The seismic profile shows two distinct buried shorelines that were formed when the water was roughly 28 feet and five feet lower.

The most remarkable story however comes from the lake sediment cores, which reveal that the lake basin was once dry enough to be a muskeg that accumulated one to two feet of peat. The bottom of the peat layer varies from six to 45 feet below the present water level, indicating that water was down at least 45 feet when the muskeg plants (mostly brown mosses and Sphagnum peat moss) were growing. A radiocarbon date on the bottom of this peat in the 2001 study yielded a date of 9550 years (calibrated). We will get more radiocarbon dates, both at the top and bottom of the peat layer in different cores to estimate how long the water level was low enough to grow terrestrial vegetation.



A seismic profile of the east lobe of Jigsaw Lake shows a flat-bottomed basin about 25 feet deep. Sediment core drilling shows one or more layers of lake sediments (mud) on top of a one to two foot thick peat layer. The peat lies on top of well-sorted glacial sand that probably washed into the original kettle hole left by a melting block of glacial ice.
Photo Credit: Tom Lowell

The lower buried shoreline—at 28 feet down—was formed after the muskeg flooded and lake sediments were being laid down. Hopefully we can find organic materials in the lake sediments which will give us a date on the time when the lower shoreline was eroding and shedding sediments into the basin.

Curiously, we also see an old wave-cut shoreline running around the lake at a height of about eight feet above the present water level. It is back in the woods and only noticeable when you are entering or leaving the lake basin. This steep scarp represents the highest water level or wettest period in the history of the lake. Erosion features like this are inherently difficult to date because the evidence has been removed, not deposited.

Because the scarp is steep we infer that the period of erosion lasted a long time. The eroded soil pretty well had to go into the lake basin, unless it was blown away, which seems unlikely. Radiocarbon dates on sticks and other organic materials in the lake sediments may provide evidence for the timing of the scarp erosion.

In the final week of the study the geologists profiled and cored the southern basin of the lake, which became detached as a separate lake when the water level fell in the 1990s. This basin also has a peat layer buried beneath lake sediments, indicating that the water level was similarly drawn down many feet below the modern lake level, presumably at the same time as in the main basin, which we will confirm with additional radiocarbon dates.

Prof. Greg Wiles from the College of Wooster, Ohio and Prof. Tom Lowell from the University of Cincinnati are leading the geology crew, assisted by undergraduates Alena Giesche from Middlebury College in Vermont, Terry Workman from Wooster, and Jessa Moser from U-Cincinnati. Funding is from the National Science Foundation through the Keck Geology Consortium and the U.S. Fish & Wildlife Service.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.